Assignment

Gloria Stephen

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Formulation of LP problem

The objective function is Max $\quad Z = 420(L_1 + L_2 + L_3) + 360(M_1 + M_2 + M_3) + 300(S_1 + S_2 + S_3)$

Rearraning the objective function Max $\quad Z = 420L_1 + 360M_1 + 300S_1 + 420L_2 + 360M_2 + 300S_2 + 420L_3 + 360M_3 + 300S_3$
subject to

$$L_1 + M_1 + S_1 \leq 750$$
$$L_2 + M_2 + S_2 \leq 900$$
$$L_3 + M_3 + S_3 \leq 450$$
$$20L_1 + 15M_1 + 12S_1 \leq 13000$$
$$20L_2 + 15M_2 + 12S_2 \leq 12000$$
$$20L_3 + 15M_3 + 12S_3 \leq 5000$$
$$L_1 + L_2 + L_3 \leq 900$$
$$M_1 + M_2 + M_3 \leq 1200$$
$$S_1 + S_2 + S_3 \leq 750$$

Non negativity constraints

$$L_1, L_2, L_3, M_1, M_2, M_3, S_1, S_2, S_3 \geq 0$$

The above LP problem constaraints can be written as

$$L_1 + M_1 + S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 750$$
$$0L_1 + 0M_1 + 0S_1 + L_2 + M_2 + S_2 + 0L_3 + 0M_3 + 0S_3 \leq 900$$
$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + L_3 + M_3 + S_3 \leq 450$$
$$20L_1 + 15M_1 + 12S_1 + 0L_2 + 0M_2 + 0S_2 + 0L_3 + 0M_3 + 0S_3 \leq 13000$$
$$0L_1 + 0M_1 + 0S_1 + 20L_2 + 15M_2 + 12S_2 + 0L_3 + 0M_3 + 0S_3 \leq 12000$$
$$0L_1 + 0M_1 + 0S_1 + 0L_2 + 0M_2 + 0S_2 + 20L_3 + 15M_3 + 12S_3 \leq 5000$$
$$L_1 + 0M_1 + 0S_1 + L_2 + 0M_2 + 0S_2 + L_3 + 0M_3 + 0S_3 \leq 900$$
$$0L_1 + M_1 + 0S_1 + 0L_2 + M_2 + 0S_2 + 0L_3 + M_3 + 0S_3 \leq 1200$$
$$0L_1 + 0M_1 + S_1 + 0L_2 + 0M_2 + S_2 + 0L_3 + 0M_3 + S_3 \leq 750$$

```
library(lpSolve)
library(tinytex)
```

```r
#Objective function

f.obj <- c(420,360,300,420,360,300,420,360,300)

#Constraints

f.con<-matrix(c(1, 1, 1, 0, 0, 0, 0, 0, 0,

                0, 0, 0, 1, 1, 1, 0, 0, 0,

                0, 0, 0, 0, 0, 0, 1, 1, 1,

                20, 15, 12, 0, 0, 0, 0, 0, 0,

                0, 0, 0, 20, 15, 12, 0, 0, 0,

                0, 0, 0, 0, 0, 0, 20, 15, 12,

                1, 0, 0, 1, 0, 0, 1, 0, 0,

                0, 1, 0, 0, 1, 0, 0, 1, 0,

                0, 0, 1, 0, 0, 1, 0, 0, 1), nrow = 9, byrow =TRUE)

#set inequality signs

f.dir<-c("<=",

         "<=",

         "<=",

         "<=",

         "<=",

         "<=",

         "<=",

         "<=",

         "<=")

#Set right hand side coefficients

f.rhs <- c(750, 900, 450, 13000, 12000, 5000, 900, 1200, 750)

#Value of Z
lp("max", f.obj, f.con, f.dir, f.rhs)


## Success: the objective function is 708000
```

```
## Success: the objective function is 22.5

#Values of the variables

lp("max", f.obj, f.con, f.dir, f.rhs)$solution
```

```
## [1] 350.0000 400.0000   0.0000   0.0000 400.0000 500.0000   0.0000 133.3333
## [9] 250.0000
```